15 July 1994
Final Progress Report
NASA Contract NAS5-33031
SwRI Project 15-3321

During the course of this contract and its predecessors, sixty papers were published in refereed journals and ninety-nine papers were presented at scientific meetings. Approximately ten papers are still in progress at contract close. Copies of these have been previously sent to the COTR.

Several unique discoveries can be attributed to work supported by LAPI. Among these are:

1. Successful modelling and comparison to experiment of ion conic generation.
2. Discovery and model verification of atmospheric photoelectrons produced by soft solar x-rays.
3. Discovery of banded ions. Banded ions are the velocity-dispersed ions from upward-accelerated electrons in inverted Vs in the opposite hemisphere.
4. Verification of earlier results that a large scale, low voltage upward parallel electric field exists over the polar caps.
5. Determination of the particle source creating SAR arcs.
6. Clarification of various wave emissions and their relation to causative sources.
7. Determination that polar drifting patches are not created at the point of observation but are convected in.
8. Determination of IMF B_y dependence of flows and currents.
9. Determination that theta auroras are on closed field lines.
10. High and low altitude determination of relative contribution of parallel and perpendicular heating in inverted Vs.
11. Clarification of processes leading to ion outflow in the polar cap.
12. Refinement of what constitutes the "real" cusp.

All of the work was accomplished with no overruns. This is true for both the hardware and the data analysis phases. Two masters and two doctoral theses were produced and supported by LAPI funding. In addition,

many college summer students were involved in data analyses and software development throughout the past thirteen years.

A data system was created to archive, plot, and analyze all DE 1 and DE 2 data, the Southwest Data Display and Analysis System (SDDAS). Under separate funding sources, an entire new generation of SDDAS using X-Windows was created with data stored on rewriteable mag-optical disks. A data restoration grant is allowing us to migrate our DE 1 and DE 2 holdings to the new archive and SDDAS. A separate mag-optical mass storage for DE has been procured. Thus, DE will live on in a useful way as long as we can maintain SDDAS. The data and analysis tools are available over Internet via WWW Mosaic to the community at large. Also, copies of SDDAS are available for remote installation.

In summary, LAPI efforts have produced significant advances in our knowledge of ITM physics, supported education, and leaves an active archive and analysis system for future use.

J. David Winningham, Ph.D.
Institute Scientist